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Optimizing Natural Fibers Processing for Use in Plastics Reinforcement

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INTRODUCTION

Bast fibers derived from plants have the potential to replace glass fibers to reinforce plastics and composites in a variety of industrial applications. These fibers have similar strength characteristics to glass and have the added benefits of being lighter, renewable, safer, and less costly. This new use for bast fibers can potentially yield economic benefits for Ohio's agricultural sector by providing an emerging market for new crops. Current technologies that incorporate bast fibers are inefficient and expensive. However, Engineering Mechanics Corporation of Columbus (Emc^2) has developed a novel technology that fibrillates the fiber bundles into finer particles, thus overcoming these challenges. While the research team has secured private and state funding to implement this technology, additional research is needed to determine optimal operational parameters.

OBJECTIVES The goal of the project is to optimize the performance and maximize the efficiency of fiber processing equipment with regard to fibrillation quality, consistency, and production rate for a variety of bast fibers, such as kenaf, jute, and flax.

The pilot plant equipment was installed at The Ohio State University campus in Wooster, Ohio. The plant was modified and optimized with regard to maximize production without changes to fiber quality or performance. After the upgrades were completed, several hundred pounds of fibrillated bast fiber were produced and delivered during the first year (2008) in preparation for the formation of reinforced plastic pellets created by compounding the fiber with plastic resin.

A combination of optical microscopy and image analysis software was used to optimize fiber dimensions that would be ideally suited as reinforcement for polymer composites. This methodology will ultimately yield a procedure for measuring and evaluating the quality of the product during the manufacturing process.

IMPACTS Results from these experiments suggest that increased throughput when processing may lead to smaller particle cross-sectional area distributions. If these results can be confirmed in future tests, then significant increases in throughput rate will be possible. Concurrently, increased production per unit of energy would also be expected.

With the global market for reinforced plastics currently at approximately $25 billion and growing by five percent per year, there are significant opportunities for replacing glass fibers with renewable bast fibers. Benefits will also be seen by the industrial sector, as a pilot-scale manufacturing plant is being developed in Wooster.

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